



Limited Visual Dam Safety Inspection Summary Report

MA-141

Wailuku Project District Retention Basin

Maui, Hawaii

Prepared by:

**U.S. ARMY CORPS OF ENGINEERS
HONOLULU ENGINEER DISTRICT**

**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES**

May 2006

Limited Visual Dam Safety Inspection Conducted on: 03 April 2006

I. Purpose

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

II. Authority

Inspections are authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statutes, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections are being conducted under joint agreements of the U.S. Army Corps of Engineers (ACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

III. Scope

Visual inspection will be made on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works would include the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there may appear to be no immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

IV. Limitations of Findings and Recommendations

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

V. Inspection Team

<u>Organization</u>	<u>Name /Title</u>
U.S. Army Corps of Engineers	Bill Empson Geotechnical Engineer
U.S. Army Corps of Engineers	Derek Chow Project Manager
State of Hawaii, Dept. of Land and Natural Resources	Edwin Matsuda Engineer

VI. Owner's Representatives Present

Stanford Carr Development	Ronald Shimizu
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VII. Summary Report Team

<u>Organization</u>	<u>Name</u>
U.S. Army Corps of Engineers	Derek Chow Bill Empson
State of Hawaii, Dept. of Land and Natural Resources	Denise Manuel Edwin Matsuda

VIII. Dam Type

The dam appeared to be an earthen embankment dam.

IX. Dam Classification

The current hazard classification of this dam is: Undetermined

The classification should be determined.

Hazard Potential Classification based on the following:

Category	Loss of Life	Economic Loss
Low	None Expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few (No Urban development and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a few	Extensive community, industry or agriculture.

Based on inventoried storage and height data, the size classification of the dam is: Most likely Intermediate but insufficient information is available to inspectors to make a determination.

Size Classification based on the following:

Category	Storage (Acre-Feet)	Height (feet)
Small	< 1000	< 40
Intermediate	> 1000 and < 50,000	> 40 and < 100
Large	> 50,000	> 100

X. Summary of Inspection

Condition Rating Criteria: The conditional terms in this report are used to generally describe the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

Satisfactory	Expected to fulfill intended function.
Fair	Expected to fulfill intended function, but maintenance is recommended.
Poor	May not fulfill intended function; maintenance or repairs are necessary.
Unsatisfactory	Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
Unknown	Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

A. General appearance:

The basin is currently under construction as an infiltration detention basin for a new subdivision.

The embankment, spillway and inlet channel are largely complete and will contain and store water. The basin has not been completely excavated. The basin will be approximately 70' deep from the top of the embankment when completed.

The reservoir appears to have a significant drainage area.

Findings and Corrective Actions:

- a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- b. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- c. Routine inspection logs were not inspected.
- d. Dam owners shall provide for routine inspection of the dam.
- e. Access to site appears to be satisfactory.
- f. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- g. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- h. Emergency Alarms / Monitors: There were no alarms or monitors observed on this reservoir.
- i. Power / Communication: There were no communication systems observed on this reservoir.

B. Access / Security:

Access to the dam was accomplished via a County roadway currently under construction. A four-wheel drive vehicle is not required.

Security issues. Access to the dam is unrestricted.

C. Intake Works:

The inflow ditch and pipes are in fair condition. Headcutting is occurring where the ditch enters the basin. Owner intends to armor during construction. Inflows are not divertable and are driven by drainage area.

Findings and Corrective Actions:

- a. The intake works appeared to be in fair to poor condition and requires corrective action.
- b. The intake works needs maintenance and/or repair. Description: Repair head cutting and armor area where ditch enters basin.

D. Reservoir:

The reservoir was dry during the inspection. A staff gage did not exist. Typically the reservoir is kept empty or low. The reservoir is still under construction and several mounds of dirt and utility poles still need to be removed. The low level outlet works has not been constructed yet.

Findings and Corrective Actions:

- The reservoir appeared to be in fair condition, and still under construction.
- A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.

E. Upstream Slope: (Fair)

The upstream slope was approximately a 2:1 to 3:1 slope (Vertical to Horizontal). The upstream slope was grassed and should be improved.

Findings and Corrective Actions:

- The upstream slope appeared to be in fair condition and requires corrective action.
- Slope protection needs maintenance or repair.

F. Crest: (Fair)

The dam crest was approximately 20 feet wide. There was a dirt access road on top of the crest. There were isolated erosion gullies observed on the crest and a few longitudinal cracks.

Findings and Corrective Actions:

- The dam crest appeared to be in fair condition and requires corrective action.
- Access along the crest was satisfactory.
- Repair surface erosion and monitor crest for any developing cracks.
- The crest is not level due to ongoing construction. The crest must be made level.

G. Downstream Slope: (Fair)

The downstream slope was approximately 1 on 3. The downstream slope had sparse grass on the east and north sides and was not visible due to heavy vegetation on the south side. There was no access other than on foot to the downstream slope and toe. Scattered minor gully erosion was observed on the east side downstream slope. Sinkholes were not observed on the downstream slope. Seepage was not observed on the downstream toe, however the reservoir was empty.

Findings and Corrective Actions:

- The downstream slope appeared to be in fair to poor condition and requires corrective action.
- Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: Improve grass cover and grade minor erosion.
- The down stream slope was not visible due to high grass on the south side. Clear high vegetation and maintain low to enable easy visual inspection.

H. Abutments / Toe: (Fair)

The abutments and toe were not entirely visible or identifiable due to heavy vegetative growth on the south side.

Findings and Corrective Actions:

- a. The abutments/toe appeared to be in fair condition and requires corrective action.
- b. The abutment/toe area was not visible due to high grass and bush vegetation.
Clear high vegetation and maintain low to enable easy visual inspection.

I. Outlet Works: (Unsatisfactory / Under Construction)

Not inspected or tested. Submersible pumps that discharge into spillway have not been installed. Still under construction, other safety measures and plans should be established to address this deficiency until the outlet works is installed and operational. This is important as the reservoir is currently receiving some runoff flows.

Findings and Corrective Actions:

- a. The outlet works appeared to be in unsatisfactory condition and requires corrective action.
- b. Feature not yet installed
- c. Provide operational safety measures and plans during the construction period.

J. Spillway: (Satisfactory)

This spillway consisted of a shotcrete lined trapezoidal channel with 2 Vertical to 1 Horizontal sideslopes. The rough dimensions were 15' x 15'. The spillway approach was clear. There was no erosion observed near the spillway.

Findings and Corrective Actions:

- a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.

K. Down Stream Channel: (Satisfactory)

The down stream channel is shotcrete lined trapezoidal channel with 2 Vertical to 1 Horizontal side slopes for some distance downstream. There is a well-defined downstream channel.

Findings and Corrective Actions:

- a. The downstream channel was not inspected.
- b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.

XI. Additional Comments:

The basin will be excavated 30' below the base of the embankment as part of construction completion.

The owner representative indicated that all identified issues would be addressed as construction is completed.

The embankment, spillway and inlet channel are largely complete and will contain and store water. Construction must be completed for the project to perform adequately. The structure should be fully operational prior to the construction of the subdivision and emergency action plans and operation plans should address the deficiencies of the uncompleted reservoir.

The foundation design of this structure for seepage, uplift, downstream pressure relief (if appropriate) and piping is more critical than most in the State inventory.

PHOTOGRAPHS

MA-141 Wailuku Project District Retention Basin

MA-141 Wailuku Project District Retention Basin



141 west side with CMP inlet - Looking from east embankment toward west side with CMP general runoff inlet visible

MA-141 Wailuku Project District Retention Basin



141 unrelated downstream basin - Detention basin east of the east embankment that is for the development just south of the embankment. Both the development and the detention basin are unrelated to this dam.

MA-141 Wailuku Project District Retention Basin



141 unrelated down stream basin 2 - Detention basin east of the east embankment that is for the development just south of the embankment. Both the development and the detention basin are unrelated to this dam.

MA-141 Wailuku Project District Retention Basin



141 unfinished reservoir looking from the north.

MA-141 Wailuku Project District Retention Basin



141 uneven crest to south - Crest area that is about 1' lower than other areas looking south

MA-141 Wailuku Project District Retention Basin



141 5 inch shotcrete spillway - Shotcrete spillway lining looking toward basin

MA-141 Wailuku Project District Retention Basin



141 spillway - Looking at spillway and south embankment from the west

MA-141 Wailuku Project District Retention Basin



141 spillway shotcrete - Upstream edge of shotcrete spillway lining showing absence of toe wall under shotcrete

MA-141 Wailuku Project District Retention Basin



141 Looking at south embankment and spillway from southeast corner

MA-141 Wailuku Project District Retention Basin



141 south heavy vegetation 1 - Back slope of south embankment showing heavy vegetation

MA-141 Wailuku Project District Retention Basin



141 south heavy vegetation 2 - Back slope of south embankment showing heavy vegetation

MA-141 Wailuku Project District Retention Basin



141 north side toward inlet - Back slope of embankment on north side looking at the east side of the inlet channel

MA-141 Wailuku Project District Retention Basin



141 looking north along east embankment from SE corner

MA-141 Wailuku Project District Retention Basin



141 inlet head cutting - Looking from inlet channel to basin

MA-141 Wailuku Project District Retention Basin



141 inlet head cut - Inlet channel and head cutting where channel meets the basin

MA-141 Wailuku Project District Retention Basin



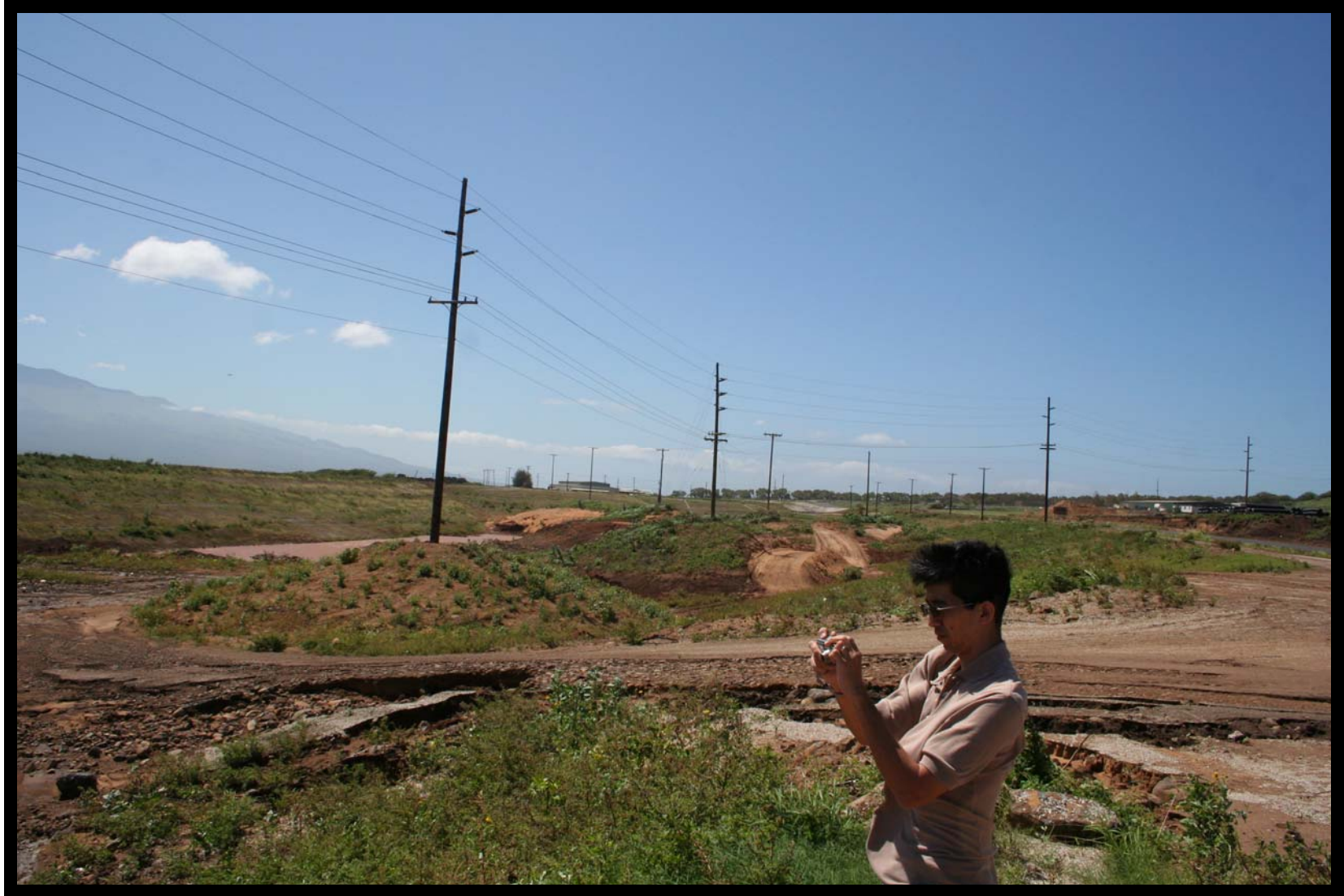
141 from SW - Looking northeast across reservoir toward east embankment

MA-141 Wailuku Project District Retention Basin



141 from SE corner - Unfinished basin from the southeast corner of embankment with east embankment on the right of the photo

MA-141 Wailuku Project District Retention Basin



141 from NW corner - Unfinished basin from the Northwest with east embankment on the left of the photo

MA-141 Wailuku Project District Retention Basin



141 from east toward inlet channel - Looking NW across reservoir from east side with inlet channel in the top left corner

MA-141 Wailuku Project District Retention Basin



141 east uneven crest - Crest area that is about 1' lower than other areas

MA-141 Wailuku Project District Retention Basin



141 east uneven crest 1 - Crest area that is about 1' lower than other areas

MA-141 Wailuku Project District Retention Basin



141 east toe - East embankment toe with no access and sparse grass

MA-141 Wailuku Project District Retention Basin



141 east side uneven crest - Crest area that is about 1' lower than other areas

MA-141 Wailuku Project District Retention Basin



141 east side ruts - Ruts on crest near southeast corner

MA-141 Wailuku Project District Retention Basin



141 east side grass and uneven - Midslope sparse grass and uneven berm on east embankment

MA-141 Wailuku Project District Retention Basin



141 east resident in brown trailer - Transient residents
downstream of east embankment

MA-141 Wailuku Project District Retention Basin



141 east mid slope

MA-141 Wailuku Project District Retention Basin



141 east embankment erosion - Sparse grass and minor erosion on downstream side of east embankment

MA-141 Wailuku Project District Retention Basin



141 east embankment erosion 2 - Sparse grass and minor erosion on downstream side of east embankment

MA-141 Wailuku Project District Retention Basin



141 Downstream residents blue awning - Transient residents downstream of SE corner

MA-141 Wailuku Project District Retention Basin



41 downstream slope south east corner

FIELD INSPECTION SHEETS

Dam ID: MA-141

Wailuku Project District Retention Basin

Vulnerability Index:

Extreme High Moderate Low
1 2 3 4

Inspection No: _____

Date: 03 April 2006

Inspection Type: _____

STATE OF HAWAII - DLNR
DAM SAFETY INSPECTION SHEET

Visual Dam Safety Inspection

Persons Present

Affiliation

Phone Number

Bill Empson

US Army Corps of Engineers

Edwin Matsuda

DLNR

Derek Chow

US Army Corps of Engineers

Ronald Shimizu

Stanford Carr Development, LLC

Weather Condition:

☐ Rain previous day ☐ Rainy ☐ Drizzle / Mist ☐ Cloudy/Overcast ☐ Partly Cloudy ☒ Sunny ☐ Dry

Comments: _____

1. General: *(Information currently on file, update as required)*

Dam/Res. Name Wailuku Project District Retention Basin

Owner Stanford Carr Development, LLC

(C053)

Owner Contact Mr. Jay Nakamura

Owner Ph. _____

Lessee _____

Lessee Ph. _____

O & M Contractor _____

O & M Ph. _____

Nearest Town Wailuku

Latitude 04760346 E GPS _____ ° (decimal)

County MAUI

Longitude 2308192 N GPS _____ ° (decimal)

Tax Map Key(s) 235002001

Dam Status In Construction:

Hazard Potential H:

Dam Size _____

Year Completed 2006

Dam Length _____ ft.

Dam Height 30 ft.

Normal Storage _____ ac.ft.

Max. Storage 490 ac.ft.

Max. Surface Area _____ ac.

Drainage Area 1.2 mi.

Spillway Type Trap. Channel

Max. Spillway Q 2700 cfs

Owner owns land under dam facility: _____

Emergency Action Plan on file with the Department: _____

Reports on file with the Department: _____

Dam Permit Application No. 19

Dam ID: MA-141

Wailuku Project District Retention Basin

Inspection No: _____

Date: 03 April 2006

2. Questions for Owner's Rep.:

Yes No Unknown Comments

Construction Plans Available	X	<input type="checkbox"/>	<input type="checkbox"/>	
Site / Facility Map	X	<input type="checkbox"/>	<input type="checkbox"/>	
Operation & Maintenance Manual	<input type="checkbox"/>	X	<input type="checkbox"/>	Homeowners Assn will be responsible for maintenance
Emergency Action Plan	<input type="checkbox"/>	X	<input type="checkbox"/>	
Modifications / Improvements	<input type="checkbox"/>	X	<input type="checkbox"/>	Under Construction (no equipment or active work during visit)
Conduct Routine Inspections	<input type="checkbox"/>	X	<input type="checkbox"/>	Under Construction
Conduct Routine Maintenance	<input type="checkbox"/>	X	<input type="checkbox"/>	
Vehicle access to site	X	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Not accessible X With Standard car <input type="checkbox"/> Requires 4-Wheel Drive
Access during heavy rains	X	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Not accessible X With Standard car <input type="checkbox"/> Requires 4-Wheel Drive
Access when spillway is flowing	X	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Not accessible X With Standard car <input type="checkbox"/> Requires 4-Wheel Drive
Other Studies Conducted	<input type="checkbox"/>	X	<input type="checkbox"/>	<input type="checkbox"/> Phase I <input type="checkbox"/> Phase II <input type="checkbox"/> Hydraulics <input type="checkbox"/> Stability <input type="checkbox"/> Hazard <input type="checkbox"/> Seismic <input type="checkbox"/> Other: _____
Incident History	<input type="checkbox"/>	X	<input type="checkbox"/>	<input type="checkbox"/> Breached <input type="checkbox"/> Overtop <input type="checkbox"/> Slide <input type="checkbox"/> Down stream Flooding <input type="checkbox"/> Other: _____
Reservoir's Current Use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Sediment <input type="checkbox"/> Irrigation <input type="checkbox"/> Recreation X Flood Control <input type="checkbox"/> Drinking Water <input type="checkbox"/> Power Generation <input type="checkbox"/> Other: Subdivision Retention Basin

Findings and Corrective Actions:

- X a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable.
- ☐ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- X d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- ☐ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- X f. Routine inspection logs were not inspected.
- X g. Dam owners shall provide for routine inspection of the dam.
- ☐ h. The dam did not appear to be maintained on a regular basis.
- X i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☐ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- X m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- X n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

Required Recommended

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Phase I Study |
| <input type="checkbox"/> | <input type="checkbox"/> | Phase II Study (Including <input type="checkbox"/> Seepage <input type="checkbox"/> Hydrology/Hydraulics <input type="checkbox"/> EAP) |
| <input type="checkbox"/> | <input type="checkbox"/> | Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity) |
| <input type="checkbox"/> | <input type="checkbox"/> | Stability Analysis |
| <input type="checkbox"/> | <input type="checkbox"/> | Seismic Analysis |
| <input type="checkbox"/> | <input type="checkbox"/> | Hazard Classification |
| <input type="checkbox"/> | <input type="checkbox"/> | Other: _____ |

Dam ID: MA-141

Wailuku Project District Retention Basin

Inspection No: _____

Date: 03 April 2006

Physical Dam Features: (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)

3. Reservoir:

Level during inspection Minimal to dry _____ ft per _____ (gage / other)

Normal Operating Level/Range Dry _____ ft per _____ (gage / other)

Description: _____

Typical Operation ☐ Spillway always flowing ☐ Kept within normal range ☒ Kept Empty ☐ Drained Daily ☐ Only filled by Storms

☐ Other: _____

Sinkhole in Res.: ☐ # Observed: _____ Size: _____ by _____ in. Deep ☐ Not Visible ☒ None Observed

Description: _____

Staff Gage: Description: None

Findings:

- ☐ a. The reservoir was not inspected.
- ☒ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The reservoir appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ e. The staff gage needs maintenance and/or repair. Description: _____
- ☒ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.
- ☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.
- ☐ h. _____

4. Intake Works Description:

☒ Number of Intakes 3

☒ Intake Culvert / Pipe

Size: 36 in and 42" in. ☐ DIP ☒ Corrugated Metal ☐ PVC ☒ HDPE ☐ Concrete ☐ Other _____

Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☒ Other Uncontrolled general runoff through culverts

☒ Ditch / Flume

Dimension: 30' x 15' (Size x Depth) Shape Trapezoid 1 on 3 slopes

Surface: ☒ Dirt ☐ Wood ☐ Concrete ☒ Lined w/ Currently bare soil; grass planned

Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other Uncontrolled runoff into channel intake to reservoir

Findings:

- ☐ a. The intake works were not inspected.
- ☐ b. The intake works were not tested.
- ☐ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ d. The intake works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ f. The intake works needs maintenance and/or repair. Description: Turf establishment required and repair and armoring of head cut at reservoir as construction is completed.
- ☐ g. _____

Dam ID: MA-141

Wailuku Project District Retention Basin

Inspection No: _____

Date: 03 April 2006

5. Upstream Slope:

(Typical Slope \pm 1 : 3)

Slope Protection: ☐ None ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Liner _____ ☐ Other: _____

☐ Defect in Protection: Description: _____

Erosion: ☒ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ # Observed: _____ Size: _____ and _____ Depth ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: Poor grass cover

Findings:

- ☐ a. The upstream slope was not inspected.
- ☐ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The upstream slope appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☒ e. Slope protection needs maintenance or repair. Description: Establish grass cover _____
- ☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ k. _____

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6. Crest:

Approximate Crest Width: 20'

Access: ☐ None ☐ Walking Path ☒ Roadway, Surface / Width / Usage: Single lane; soil; Elevation approx 384'

Erosion: ☒ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☐ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☒ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: Minimal grass cover or bare soil

Findings:

- ☐ a. The dam crest was not inspected.
- ☐ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The dam crest appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☒ e. Access along the crest was satisfactory.
- ☐ f. Access along the crest was not possible. Description: _____
- ☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____
- ☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☒ l. The crest elevation varies significantly due to construction. The crest must be a consistent elevation.

Dam ID: MA-141

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Inspection No: _____

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7. Downstream Slope:

(Typical Slope \pm 1 : 3)

Access: ☐ lower roadway along toe ☐ roadway to outlet works ☐ walkway to outlet works ☒ None Observed

Slope Protection: ☒ None ☐ Dumped Rock ☐ Rip Rap ☐ Grouted Rip Rap ☐ Concrete

Erosion: ☐ Loose soil w/ little vegetation ☒ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☐ None Observed

Description: Minor erosion on east side embankment in isolated locations

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☐ None ☒ Low Ground Cover ☒ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: Sparse grass to tall grass on north and east embankments; tall vegetation on southern embankments

Seepage: Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

- ☐ a. The downstream slope was not inspected.
- ☐ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The downstream slope appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☒ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair.
Description: East embankment requires turf improvement and minor grading.
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☒ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection. South embankments.
- ☐ g. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ h. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ i. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
- ☐ j. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.
- ☐ k. _____

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Inspection No: _____

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8. Abutments/Toe:

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☐ None ☒ Low Ground Cover ☒ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: Tall grass on south embankments

Seepage: Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

- ☐ a. The abutments/toe were not inspected.
- ☐ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☒ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
- ☐ l. _____

Dam ID: MA-141

Wailuku Project District Retention Basin

Inspection No: _____

Date: 03 April 2006

9. Outlet Works:

Culvert / Pipe

Type / Size: Submersible pumps discharging to spillway are still to be installed.

Culvert: ☐ Concrete ☐ Masonry ☐ unlined earth ☐ Other _____

Pipe: ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control Type: ☐ Gate ☐ Valve ☐ Other _____

Location: ☐ Control on Upstream side ☐ Control on Downstream side

Seepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

- X a. The outlet works were not inspected. Not installed.
- ☐ b. The outlet works were not tested.
- ☐ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.
- ☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ i. _____
- ☐ j. _____

10. Spillway:Type: ☐ None ☐ Culvert/Pipe ☒ Channel

Description: 5" thick shotcrete with 6" x 6" mesh over soil. No toe wall at reservoir.

Dimension: 15' x 15' trap. 1 on 2 slopes ft. Invert elevation: Not available ft. per staff gage

Slope Protection: ☐ None ☐ Grass ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☒ Concrete☐ Defect in Protection: Description: _____Approach: ☒ Clear ☐ High Veg. ☐ Trees☐ Other: _____Erosion: ☐ Scour ☐ Gully ☐ Headcut☐ Not Observed☐ Other: _____

Description: None

Vegetation: ☒ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Findings:

- ☒ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.
- ☐ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ d. Slope protection needs maintenance or repair. Description: _____
- ☐ e. The spillway approach was blocked. Clear approach.
- ☐ f. Severe scour erosion was observed which requires maintenance and/or repair.
Description: _____
- ☐ g. A headcut (vertical drop in channel due to erosion) was observed downstream of the spillway. Corrective action is required to prevent this problem from moving upstream.
- ☐ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
- ☐ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.
- ☐ j. _____

11. Down Stream Channel:

Name: Shotcrete lined channel

Downstream: ☐ Sump ☐ Open Area ☐ Un-Defined Drainage-way ☒ Defined Drainage-way ☐ Other _____Items along Stream Bank: ☒ None ☐ Road ☐ Houses ☐ Town ☐ Not Inspected

Description: _____

Findings:

- ☒ a. The downstream channel was not inspected.
- ☒ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. _____

Additional Comments:

At the time of the inspection, the project was stated by the owner's representative to be in construction. No active work was underway and no equipment was observed immediately adjacent to the site. The project will impound water to a depth of approximately 30' below the spillway invert in its current condition.

Owner's representative stated that there is still 20-30' of excavation to go below the base of the current reservoir. It appears that all of that excavation at a depth below the base of the embankment. Some of the power poles in the reservoir will be relocated and pumps will be installed.

The basin is designed as an infiltration basin with some pump out capacity. The pumping system is currently being designed so capacity is unknown at this time.

Head cutting is occurring where the inlet channel meets the basin. The owner's representative stated that he intends to repair and armor this area as construction is completed.

At least two transient residences exist immediately downstream of the dam.

Design Note: It should be confirmed that the embankment design adequately addresses foundation conditions, underseepage, uplift and downstream foundation pressure relief since this basin could impound up to 70' water depth on a pervious foundation if constructed as stated. A foundation piping failure mode (even for a temporary pool on a dry drain) is more of a concern on this structure than others in the State inventory.

The embankment, spillway and inlet channel are largely complete and will contain and store water. Construction must be completed for the project to perform adequately.

Limitations and Intent of this Dam Safety Inspection:

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statutes Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.